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(56) Documents Cited
GB 2077508 A EP 0172783 A2 WO 90/10920 A1
US 4888581 A

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(54) Abstract Title
Pressure-sensitive floor covering enabling motion and position tracking

(57) A mat contains electrical pressure sensing components (7) which respond to the position of an object such as a person walking across the mat. Electrical signals from the pressure sensors are converted by electronic hardware into a spatial code which can be read by a computer, so that computer processes can respond to changes in position of for example, a person walking across the mat. In another embodiment (Fig.3), two pairs of continuous conductors are used, with the position of the person being detected by the change in current caused by the effecting impedance change in the circuits of the conductor pairs due to the person stepping on a particular point in the mat.

FIG 2

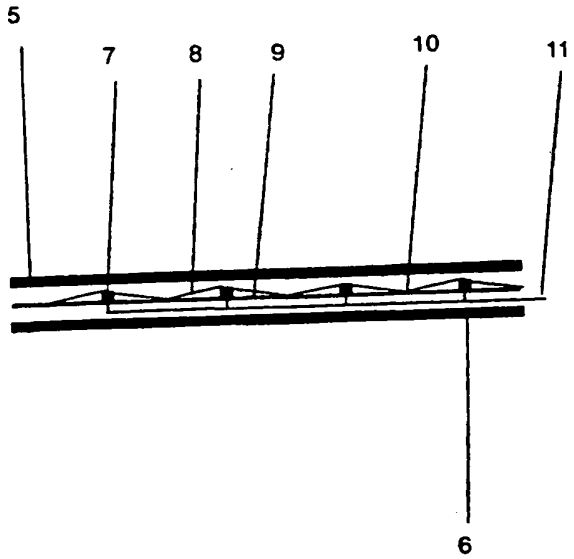

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FIG 1

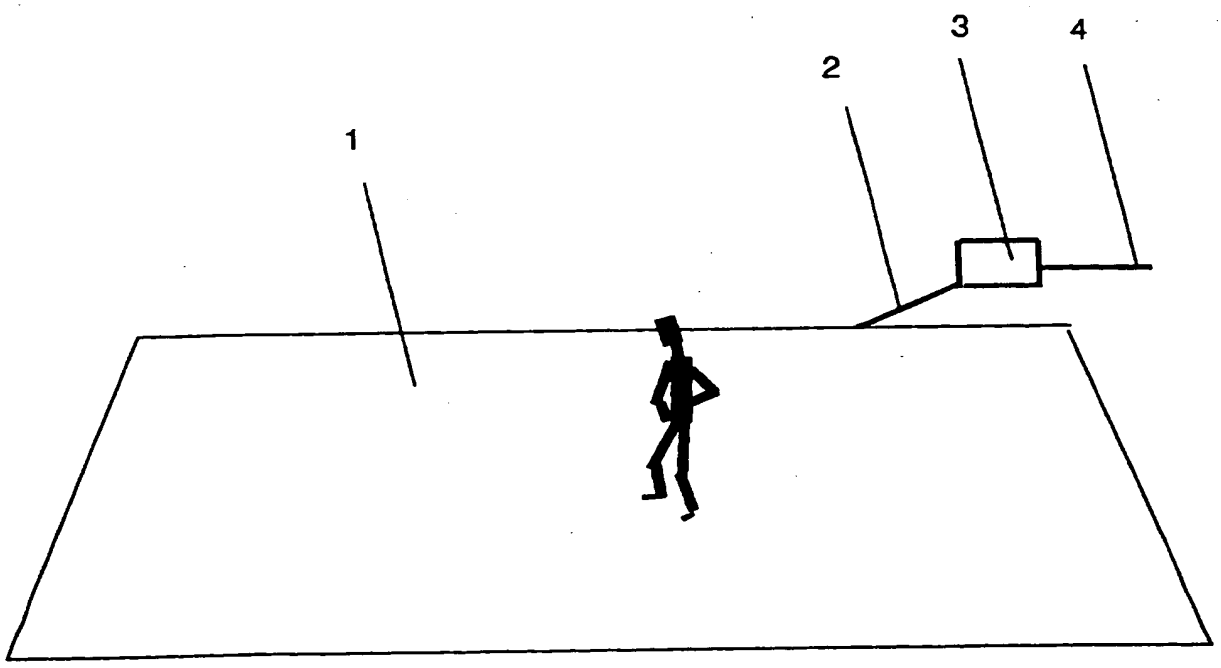


FIG 2

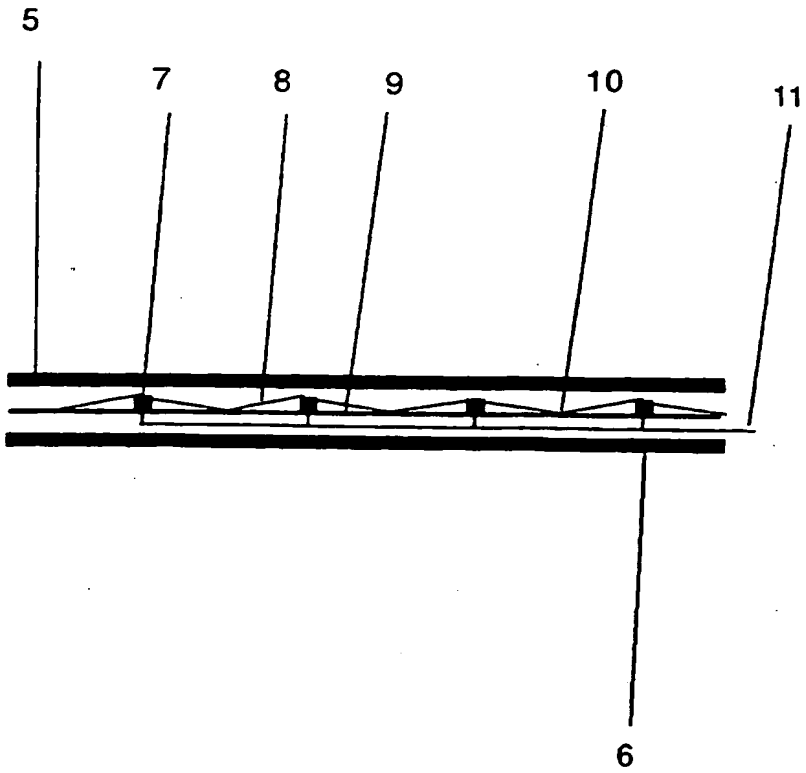
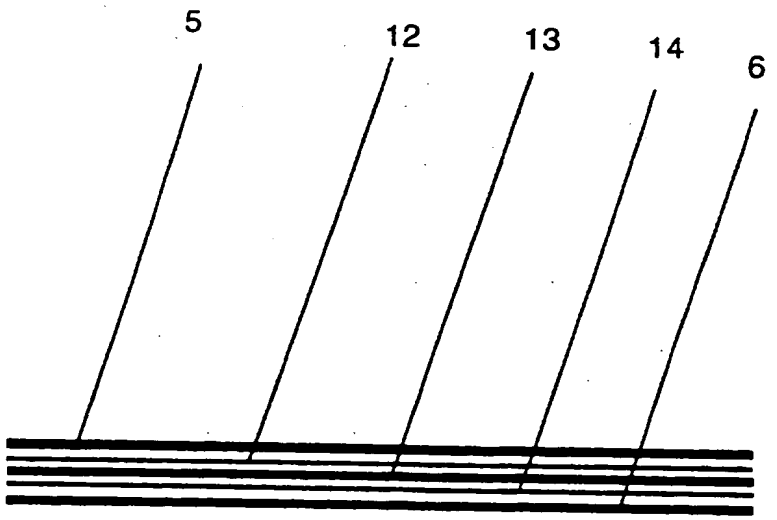


FIG 3



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POSITION AND MOTION TRACKER

This invention relates to technology enabling computers to monitor the position of moving objects.

Exisitng technology for tracking the position of objects moving across a surface is of two types:
1) Computer draw pads. These track the position of a pen across a surface and feed the information to a computer.
2) Touch sensitive computer screens.

The current invention is a system for tracking larger objects such as humans across a larger surface to enable computer-generated visual displays to respond to movement of an object (eg. a person walking across a floor). These 'interactive' computer generated visuals would include screen images, laser displays and holograms.

According to the present invention there is a 'mat' which is laid or fixed on top of a horizontal surface (eg. on a floor) on which an object is moving. The mat contains electronic sensors and an electronic coding device such that:

a) The position of the object on the mat is electronically sensed,

b) Object position is output in a form which is readable by a computer, and at a rate which will enable real-time interactive visual displays.

Two specific embodiments of the invention will now be described. The first uses discrete sensors (the 'discrete scale embodiment'). The second uses a method for generating positional information along a continuous scale (the 'continuous scale embodiment').

Figure 1 shows an external perspective view for either embodiment.
Figure 2 shows a cross section of the mat in the discrete scale example.
Figure 3 shows a cross section of the mat in the continuus scale example.

Common features of both embodiments

Figure 1 illustrates the overall form of the invention.
The mat (1) is multi-layered, the inner layers containing pressure sensing components and wiring which connects to a multicore electrical output cable (2). This connects to an electronic unit (3) which translates the outputs from the sensing components into a computer readable code (analogue or digital) using standard electronic methods. This code is output into a cable (4) which connects to the visual display controlling computer. As an object (the human figure in figure 1) moves around on the mat, the positional code received by the computer is updated to reflect the current state of the sensors as determined by the position of the object(s) on the mat.

Discrete scale embodiment

Figure 2 shows a cross section of the mat. The upper layer (5) is a flexible, durable and waterproof covering (eg. polythene sheet). The next layer down contains pressure sensors (7) distributed over the entire area of the mat in a regular pattern

(eg. a rectangular or trianguar lattice), the spacing of these depending on the spatial resolution requirements of the computer. The pressure sensors are covered by a plastic sheet (8) which is fixed to the more rigid next layer down (9) at points (10) in between adjacent sensors in such a way that pressure on 8 at any point will cause pressure to be transmitted to the nearest sensor. Each sensor connects to a wire (11) which runs underneath 9 and ultimately emerges in the output cable (4). The bottom layer (6) of the mat forms a durable base to protect and support the sensors and wiring.

Continuous scale embodiment

Figure 3 shows a cross section of the mat in this example. The uppermost (5) and lowermost (6) layers are similar to those in the previous example. The inner layers are designed such that pressure causes contact to be made between the 'conducting' layers (12 & 14) which allow current to pass, ultimately to the output cable (4). The magnitude of this current is proportional to the left/right position of the object (or person) on the mat. This is achieved by using materials for the conducting layers which produce significant changes in resistance depending on how far the current must pass along the conductors (which depends on the location on the mat where the contact is made). In order to represent front/back position at the same time as left/right position, there would be two interleaved versions of the previous design and two outputs, one for each axis of movement. The precise structure of these interleaved layers will not be defined here as the example merely aims to outline the basic principles of a continuous scale embodiment.

CLAIMS

1) A device for monitoring the position of objects such as persons moving across a surface by means of pressure sensing components which respond to shifts in weight on the surface.

2) A device for monitoring objects as claimed in Claim1 which uses standard electronic methods to convert outputs from pressure sensing components into a computer readable code representing the position of an object on the surface over which the sensors operate, so that computer processes can respond to changes in object position.

3) A device for monitoring objects as claimed in Claim1 or Claim 2 involving discrete pressure sensors distributed over an object-supporting surface.

4) A device for monitoring objects as claimed in Claim1 or Claim 2, which recovers object position through changes in the strength of an electrical current emanating from changes in resistance in a circuit due to changes in the position at which contact is made across the length of two separated layers of conducting material in response to a shift in pressure on the surface caused by a shift in position of an object resting on the surface.

5) A device for monitoring objects as claimed in Claim1 or Claim 2 or Claim 3 or Claim 4 in which the pressure sensing devices are contained in a multi-layered mat.

6) A device for monitoring objects as claimed in Claim 5 in which the mat is flexible so that it can be rolled up when it needs to be moved.

7) A device for monitoring objects as claimed in Claim 5 in which the mat can be dismantled into smaller sections when it needs to be moved.

Amendments to the claims have been filed as follows

AMMENDED CLAIMS

1) A system for applying motion-capture to real-time computer generated visuals (especially screen images, lasers and holographs) which involves:
   a) a pressure sensitive floor covering having electronic outputs which encode the 2-dimensional position and motion of objects on its surface.
   b) an interface by which such outputs are converted into digital information which can be read in computer software.
   c) computer software that uses such positional information to control real-time visual displays, i.e. to make such visual displays interact with the movements of a human viewer or viewers located within the area of the pressure sensitive floor covering.

2) A system as claimed in Claim 1 in which pressure sensing devices are embedded in a multi-layered construction (pressure sensing mat) which is laid on &/or attached to the floor.

3) A system as claimed in Claim 1 and Claim 2 involving a 2-dimensional array of discrete pressure sensors.

4) A system as claimed in Claim 1 and Claim 2 which recovers object position through changes in the strength of an electrical current emanating from changes in resistance in a circuit due to changes in the position at which contact is made across the length of 2 separated layers of conducting material which are embedded in a multi-layered construction as claimed in Claim 2.

5) A system as claimed in Claim 2 in which the pressure sensing mat is constructed in easily movable sections which connect together, so that different areas and shapes of floor space can be covered by connecting different numbers of such sections together.

The Patent Office

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Application No: GB 9707827.3
Claims searched: 1-7

Examiner: Steven Davies
Date of search: 12 February 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): G1N-NACNP,NACNR,NAHE ; G4N-NPPXP ; H1N-NUJD

Int Cl (Ed.6): G08B-13/10 ; H01H-3/14

Other: Online database: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2077508 A	(WEATHERLY) the whole document	
A	EP 0172783 A2	(CYBERTRONICS) e.g. pages 3-7	
X	WO 90/10920 A1	(LEWIN) the whole document	1-3,5-7
X	US 4888581	(GUSCOTT) the whole document	1-3,5

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.